



Final Report

Scrap Metal Shredding and Processing Emissions Testing – wTe Recycling, Inc. Greenfield, MA

Test Dates: November 18-20, 2015

Prepared for . . .

wTe Recycling, Inc. -
Greenfield, MA

Prepared by . . .

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2. Auto Feedstock – Cyclone 2
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4. [REDACTED] – Scrubber / Cyclone 1
5. [REDACTED] – Cyclone 2
6. [REDACTED] – Cyclone 3
7. Blend Feedstock – Scrubber / Cyclone 1
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1. Auto Feedstock – Scrubber / Cyclone 1
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3. Auto Feedstock – Cyclone 3
4. [REDACTED] – Scrubber / Cyclone 1
5. [REDACTED] – Cyclone 2
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7. Blend Feedstock – Scrubber / Cyclone 1
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- D - Laboratory Analytical Reports
 - 1. Particulate Matter / Trace Metals
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Revision Description

Report: Final Report – EPA Emissions Testing
wTe Recycling, Inc. – Greenfield, MA

Revision Number	Revision Date	Revision Description

1.0 INTRODUCTION

1.1 Background

The United States Environmental Protection Agency (USEPA or EPA) is seeking better emissions characterization of automobile shredding operations, and as part of a Section 114 request issued a Clean Air Act Testing Order for wTe Recycling, Greenfield, MA (wTe) on June 4, 2015. The order was to conduct emissions testing of volatile organic compounds (VOC), particulate matter (PM), and hazardous air pollutants (HAP) from the shredding and processing of scrap automobiles. Scrap automobiles represent a small portion of the feedstock materials processed at wTe, and wTe therefore proposed that in addition to scrap automobiles, several additional tests would also be performed to better characterize emissions from its representative feedstocks. Eastmount Environmental Services, LLC, an affiliate of Montrose Air Quality Services, LLC (“Montrose”), was retained by wTe Recycling, Inc. to conduct emissions testing based on a formal testing protocol approved by USEPA. Testing occurred on November 18-20, 2015. Contact information for the parties involved in this test program is presented in Table 1-1.

1.2 Program Overview

Montrose conducted emissions testing on the three shredding process exhaust stacks at the wTe facility: 1) the main cyclone/scrubber (Scrubber/Cyclone #1), 2) the secondary cyclone (Cyclone #2), and 3) the tertiary cyclone (Cyclone #3).

Three distinct feedstocks were processed separately during the testing: 1) flattened automobile hulks (Autos), 2) [REDACTED], and 3) a “normal representative mixture” of flattened automobile hulks, light iron, and [REDACTED] (Blend). Three 60-minute test runs were performed for each feedstock, and emissions samples were collected simultaneously at the three test locations during each test run.

In addition to measuring PM, VOC, and HAP, the trace metals beryllium, cadmium, lead and mercury, were also measured. Table 1-2 lists the test parameters, test methodologies, and test run durations for the emissions testing program.

All preparation, testing, analysis and calculations were conducted in strict accordance with the procedures approved by 40 CFR 60 Appendix A, the EPA Quality Assurance Handbook (Vol. III), and the approved Test Protocol as amended. A detailed explanation of the methodology, procedures and equipment used can be found in Sections 4 and 5 of this Final Report.

Anthony Stratton, Senior Project Manager, was responsible for all phases of the stack emissions test program. He was assisted by a qualified staff of Environmental Engineers and Technicians. wTe Recycling personnel collected all process data. Mr. Christopher Pichette, wTe Recycling's General Manager, was responsible for facility operations during the emission's test program.

1.3 Final Report Organization

The remainder of this Final Report is organized into four sections. Section 2 provides Summary of Results tables for the entire program. Section 3 presents a source and sampling point description. A description of the flue gas monitoring procedures is provided in Section 4, while Section 5 addresses the quality assurance/quality control aspects of the program. All supporting field data, emissions calculations, equipment calibration, laboratory analytical data, and process data are appended to this report.

Table 1-1 Program Informational Summary

Source Information	
Facility Name:	wTe Recycling, Inc.
Facility Address:	75 Southern Avenue Greenfield, MA 01302
Facility Contact:	Mr. Christopher Pichette
Phone:	(413) 772-2200
Email:	cpichette@wTe.com
Test Firm Information	
Test Organization:	Eastmount Environmental Services, LLC
Address:	2 New Pasture Road, Suite 5 Newburyport, MA 01950
Contact:	Mr. Anthony Stratton, QSTI
Phone:	(978) 499-9300 x12
Email:	astratton@montrose-env.com.com
Federal Information	
Organization:	USEPA, Region 1
Address:	Region 1, New England 11 Technology Drive N. Chelmsford, MA 01863
Contact:	Mr. William Osbahr
Phone:	(617) 918-8389
Email:	osbahr.william@epa.gov

Table 1-2 Test Parameters and Methodologies

Pollutant	Test Method	Run Duration
Particulate Matter (PM)	EPA 5	60 min.
Trace Metals (Be, Cd, Pb, Hg)	EPA 29 (combined with EPA 5)	60 min.
Volatile Organic Compounds (VOC)	EPA 25A	60 min.
Hazardous Air Pollutants (HAP)	TO-15 (Summa)	60 min.
Volumetric Flow	EPA 1 through 4	As required

Table 1-3 Test Log

Date	Feedstock	Test Event - Time
18 Nov 2015	Autos	Auto – Run 1 09:59-10:59 Auto – Run 2 12:28-13:28 Auto – Run 3 14:32-15:32 (Void)
19 Nov 2015	Autos	Auto – Run 4 07:39-08:39
	██████████	██████ – Run 1 09:51-10:51 ██████ – Run 2 12:32-13:32 ██████ – Run 3 14:38-15:38
20 Nov 2015	Blend (Autos, ██████ and Light Iron)	Blend – Run 1 08:09-09:09 Blend – Run 2 10:16-11:21 Blend – Run 3 12:16-13:16

2.0 SUMMARY OF RESULTS

2.1 General

The following section serves to summarize the results for all sampling that took place on the three emission points at the wTe facility. Tables 2-1 through 2-3 provide overall mass emission summaries in lb/hr of all parameters at all locations for each of the three feedstocks. Table 2-4 through 2-12 provide individual test run summaries for PM, metals, VOC, and supporting test data for all three locations and all three feedstocks. Tables 2-13 through 2-21 provide individual run summaries for HAP at each location, including a sum of all detected HAPs plus the maximum observed HAP compound.

2.2 Discussion

2.2.1 Scrubber / Cyclone #1 Location Safety During Sampling

It should be noted that for sampling at the Scrubber/Cyclone #1 location, it was unsafe to stage personnel at the stack location while the process was running. Therefore, prior to each test run, a preliminary stack flow traverse was conducted at the Scrubber / Cyclone #1 location. Once the traverse was completed, the leak-checked isokinetic sampling train was placed at a point of observed average stack velocity. The Summa canister was also set up at this time, and the Summa probe was placed in the stack center. When the process was ready to go, the Summa valve was opened, and the area was immediately cleared of personnel, at which time the process was re-initiated and sampling then commenced. At the completion of the each test run, the process was suspended, and the Eastmount technician returned to the location to shut off the Summa valve, post leak check the isokinetic sampling train, and rinse and seal the train in accordance with EPA Method 5 and 29.

2.2.2 Voided Test Run

In general, all sampling proceeded as planned without incident. Only one PM/metals sampling train, "Auto-C2-R3", failed a post leak check. This occurred during the third run of the Auto test series. As a result, all tests conducted during the "Auto-Run 3" test were voided, and a fourth Auto test run was performed for all parameters at all three locations on November 19, 2016.

2.2.3 VOC Over-Ranging During [REDACTED] Processing

During VOC sampling when processing [REDACTED], an unexpected and apparently anomalous VOC concentration that exceeded the analyzer's 0-1000 ppm operating range was observed. The VOC analyzer range was immediately increased to 0-5000 ppm to capture elevated concentrations from that point forward. At the completion of the test run, the analyzer was first post-calibrated with the zero and high level methane gas used during the pre-calibration, and then was successfully challenged with a 3000 ppm methane standard to verify that the analyzer was linear at its newly selected operating range. The cause of these unexpected readings on [REDACTED] was un-identified at the time of the test.

2.2.4 Summary of Results Tables

The following pages contain tables summarizing the emissions results for the entire program.

Table 2-1 Sum of Average Mass Emissions – Auto Feedstock

Process Scenario:		Auto Feedstock			Sum of 3 Locations (lb/hr)
Date:		November 18-19, 2015			
Location:		Scrubber/Cyclone 1	Cyclone 2	Cyclone 3	
Beryllium	lb/hr	< 1.92E-05	< 1.03E-05	< 1.01E-05	< 3.96E-05
Cadmium	lb/hr	2.20E-04	1.14E-04	7.59E-05	4.10E-04
Lead	lb/hr	9.43E-04	1.72E-03	1.44E-03	4.11E-03
Mercury	lb/hr	1.45E-03	2.53E-05	1.89E-05	4.97E-04
Particulate Matter	lb/hr	2.20	1.61	1.91	5.72
Volatile Organic Compounds	lb/hr	7.13	0.176	0.163	7.47
HAP	lb/hr	4.106	0.319	0.0058	4.43

Table 2-2 Sum of Average Mass Emissions – █████ Feedstock

Process Scenario:					Sum of 3 Locations
:		19-Nov-15			
Location:		Scrubber/Cyclone 1	Cyclone 2	Cyclone 3	
Beryllium	lb/hr	< 1.83E-05	< 9.89E-06	< 1.02E-05	< 3.85E-05
Cadmium	lb/hr	2.41E-04	3.63E-04	2.86E-04	8.89E-04
Lead	lb/hr	2.68E-04	1.23E-03	9.15E-04	2.41E-03
Mercury	lb/hr	1.39E-03	4.30E-05	2.60E-05	4.87E-04
Particulate Matter	lb/hr	1.46	3.86	2.34	7.66
Volatile Organic Compounds	lb/hr	111.5	3.64	1.51	116.6
HAP	lb/hr	53.6	2.23	1.21	57.0

Table 2-3 Sum of Average Mass Emissions – Blend Feedstock

Process Scenario:		Blended Feedstock			Sum of 3 Locations (lb/hr)
Date:		20-Nov-15			
Location:		Scrubber/Cyclone 1	Cyclone 2	Cyclone 3	
Beryllium	lb/hr	< 1.87E-05	< 9.61E-06	< 9.96E-06	< 3.83E-05
Cadmium	lb/hr	2.23E-04	9.15E-05	6.01E-05	3.75E-04
Lead	lb/hr	2.81E-04	9.51E-04	5.58E-04	1.79E-03
Mercury	lb/hr	5.18E-04	1.81E-05	1.61E-05	1.84E-04
Particulate Matter	lb/hr	1.22	1.36	0.82	3.40
Volatile Organic Compounds	lb/hr	5.82	0.122	0.127	6.07
HAP	lb/hr	7.83	0.473	0.381	8.68

Table 2-4 Summary of Results – PM, Metals, VOC – Auto Feedstock – Scrubber/Cyclone #1

Parameter	Units	Run No.			Average
		Auto-C1-R1	Auto-C1-R2	Auto-C1-R4	
Date	MM/DD/YY	18-Nov-15	18-Nov-15	19-Nov-16	
Start Time	HH:MM	9:59	12:28	7:39	
Stop Time	HH:MM	10:59	13:28	8:39	
Beryllium	ug/M3	< 0.134	< 0.136	< 0.137	< 0.135
	lb/hr	< 1.96E-05	< 1.93E-05	< 1.87E-05	< 1.92E-05
Cadmium	ug/M3	1.54	1.92	1.18	1.55
	lb/hr	2.26E-04	2.73E-04	1.62E-04	2.20E-04
Lead	ug/M3	9.83	7.54	2.32	6.56
	lb/hr	1.44E-03	1.07E-03	3.18E-04	9.43E-04
Mercury	ug/M3	5.0	15.6	10.3	10.3
	lb/hr	7.28E-04	2.21E-03	1.40E-03	1.45E-03
Particulate Matter	mg/M3	25.4	12.1	8.55	15.4
	lb/hr	3.73	1.72	1.17	2.20
Volatile Organic Compounds	ppmvd	59.4	83.0	85.2	75.9
	lb/hr	5.80	7.84	7.75	7.13
Stack O ₂	%	20.9	20.9	20.9	20.9
Stack CO ₂	%	0.0	0.0	0.0	0.0
Stack Flow	dscfh	2349398	2273077	2190033	2270836
Stack Flow	acfh	2443389	2369517	2325882	2379596
Stack Moisture	%	2.1	2.1	2.8	2.3
Stack Velocity	ft/sec	90.50	87.76	86.14	88.13
Stack Temp	°F	82.4	83.6	86.6	84.2
Isokinetics	%	92.0	93.6	95.8	93.8

Table 2-5 Summary of Results – PM, Metals, VOC – Auto Feedstock – Cyclone #2

Parameter	Units	Run No.			Average
		Auto-C2-R1	Auto-C2-R2	Auto-C2-R4	
Date	MM/DD/YY	18-Nov-15	18-Nov-15	19-Nov-16	
Start Time	HH:MM	10:01	12:28	7:39	
Stop Time	HH:MM	11:01	13:28	8:39	
Beryllium	ug/M3	< 0.160	< 0.149	< 0.150	< 0.153
	lb/hr	< 1.11E-05	< 9.87E-06	< 9.90E-06	< 1.03E-05
Cadmium	ug/M3	2.41	0.709	1.95	1.69
	lb/hr	1.66E-04	4.69E-05	1.29E-04	1.14E-04
Lead	ug/M3	17.5	14.8	45.2	25.8
	lb/hr	1.21E-03	9.82E-04	2.98E-03	1.72E-03
Mercury	ug/M3	0.323	0.376	0.435	0.378
	lb/hr	2.23E-05	2.49E-05	2.87E-05	2.53E-05
Particulate Matter	mg/M3	18.8	13.8	39.5	24.0
	lb/hr	1.30	0.913	2.61	1.61
Volatile Organic Compounds	ppmvd	4.02	4.69	3.14	3.95
	lb/hr	0.185	0.206	0.138	0.176
Stack O ₂	%	20.9	20.9	20.9	20.9
Stack CO ₂	%	0.0	0.0	0.0	0.0
Stack Flow	dscfh	1105216	1059263	1056931	1073804
Stack Flow	acfh	1056162	1025027	1043345	1041512
Stack Moisture	%	1.1	1.3	1.5	1.3
Stack Velocity	ft/sec	70.41	68.34	69.56	69.43
Stack Temp	°F	48.1	53.5	58.8	53.4
Isokinetics	%	87.6	98.4	97.3	94.4

Table 2-6 Summary of Results – PM, Metals, VOC – Auto Feedstock – Cyclone #3

Parameter	Units	Run No.			Average
		Auto-C3-R1	Auto-C3-R2	Auto-C3-R4	
Date	MM/DD/YY	18-Nov-15	18-Nov-15	19-Nov-16	
Start Time	HH:MM	9:59	12:28	7:39	
Stop Time	HH:MM	10:59	13:28	8:39	
Beryllium	ug/M3	< 0.145	< 0.144	< 0.147	< 0.145
	lb/hr	< 1.01E-05	< 1.02E-05	< 1.01E-05	< 1.01E-05
Cadmium	ug/M3	1.42	0.534	1.32	1.09
	lb/hr	9.91E-05	3.78E-05	9.08E-05	7.59E-05
Lead	ug/M3	14.8	8.80	38.9	20.8
	lb/hr	1.04E-03	6.22E-04	2.67E-03	1.44E-03
Mercury	ug/M3	0.236	0.285	0.293	0.271
	lb/hr	1.65E-05	2.01E-05	2.01E-05	1.89E-05
Particulate Matter	mg/M3	30.7	12.3	39.7	27.6
	lb/hr	2.15	0.867	2.72	1.91
Volatile Organic Compounds	ppmvd	3.35	3.31	3.91	3.52
	lb/hr	0.156	0.156	0.179	0.163
Stack O ₂	%	20.9	20.9	20.9	20.9
Stack CO ₂	%	0.0	0.0	0.0	0.0
Stack Flow	dscfh	1119675	1132915	1098462	1117017
Stack Flow	acfh	1066967	1084910	1079754	1077210
Stack Moisture	%	9.7	0.6	1.4	3.9
Stack Velocity	ft/sec	71.13	72.33	71.98	71.81
Stack Temp	°F	47.3	51.8	57.0	52.0
Isokinetics	%	104.7	103.8	104.1	104.2

Table 2-7 Summary of Results – PM, Metals, VOC – [REDACTED] – Scrubber/Cyclone #1

Parameter	Units	Run No.			Average
		[REDACTED]-C1-R1	[REDACTED]-C1-R2	[REDACTED]-C1-R3	
Date	MM/DD/YY	19-Nov-15	19-Nov-15	19-Nov-15	
Start Time	HH:MM	9:51	12:32	14:38	
Stop Time	HH:MM	10:51	13:32	15:38	
Beryllium	ug/M3	< 0.133	< 0.136	< 0.138	< 0.136
	lb/hr	< 1.80E-05	< 1.82E-05	< 1.88E-05	< 1.83E-05
Cadmium	ug/M3	1.52	1.62	2.21	1.79
	lb/hr	2.06E-04	2.16E-04	3.01E-04	2.41E-04
Lead	ug/M3	1.71	1.93	2.33	1.99
	lb/hr	2.31E-04	2.57E-04	3.17E-04	2.68E-04
Mercury	ug/M3	6.59	14.3	10.1	10.3
	lb/hr	8.91E-04	1.91E-03	1.38E-03	1.39E-03
Particulate Matter	mg/M3	10.4	9.94	12.2	10.9
	lb/hr	1.41	1.33	1.65	1.46
Volatile Organic Compounds	ppmvd	1202.4	1265.8	1259.1	1242.4
	lb/hr	108.2	112.5	113.8	111.5
Stack O ₂	%	20.9	20.9	20.9	20.9
Stack CO ₂	%	0.0	0.0	0.0	0.0
Stack Flow	dscfh	2165559	2139012	2174960	2159844
Stack Flow	acfh	2332857	2306947	2351139	2330314
Stack Moisture	%	3.4	3.0	3.2	3.2
Stack Velocity	ft/sec	86.40	85.44	87.08	86.31
Stack Temp	°F	91.1	93.2	93.3	92.5
Isokinetics	%	99.5	98.4	95.2	97.7

Table 2-8 Summary of Results – PM, Metals, VOC – [REDACTED] – Cyclone #2

Parameter	Units	Run No.			Average
		████-C2-R1	████-C2-R2	████-C2-R3	
Date	MM/DD/YY	19-Nov-15	19-Nov-15	19-Nov-15	
Start Time	HH:MM	9:51	12:32	14:39	
Stop Time	HH:MM	10:51	13:32	15:38	
Beryllium	ug/M3	< 0.165	< 0.165	< 0.154	< 0.161
	lb/hr	< 1.06E-05	< 9.37E-06	< 9.72E-06	< 9.89E-06
Cadmium	ug/M3	11.07	3.05	3.25	5.79
	lb/hr	7.09E-04	1.73E-04	2.05E-04	3.63E-04
Lead	ug/M3	35.5	10.0	13.4	19.6
	lb/hr	2.28E-03	5.67E-04	8.45E-04	1.23E-03
Mercury	ug/M3	0.584	0.930	0.614	0.710
	lb/hr	3.74E-05	5.28E-05	3.89E-05	4.30E-05
Particulate Matter	mg/M3	126.7	18.0	38.6	61.1
	lb/hr	8.11	1.02	2.44	3.86
Volatile Organic Compounds	ppmvd	92.9	93.8	81.0	89.2
	lb/hr	3.96	3.54	3.41	3.64
Stack O ₂	%	20.9	20.9	20.9	20.9
Stack CO ₂	%	0.0	0.0	0.0	0.0
Stack Flow	dscfh	1025352	908541	1012937	982277
Stack Flow	acfh	1030668	919890	1028012	992857
Stack Moisture	%	1.9	2.7	2.2	2.3
Stack Velocity	ft/sec	68.71	61.33	68.53	66.19
Stack Temp	°F	65.8	67.4	69.1	67.4
Isokinetics	%	91.0	102.6	99.0	97.5

Table 2-9 Summary of Results – PM, Metals, VOC – [REDACTED] – Cyclone #3

Parameter	Units	Run No.			Average
		[REDACTED]-C3-R1	[REDACTED]-C3-R2	[REDACTED]-C3-R3	
Date	MM/DD/YY	19-Nov-15	19-Nov-15	19-Nov-15	
Start Time	HH:MM	9:51	12:32	14:38	
Stop Time	HH:MM	10:51	13:32	15:38	
Beryllium	ug/M3	< 0.147	< 0.181	< 0.149	< 0.159
	lb/hr	< 1.03E-05	< 1.07E-05	< 9.75E-06	< 1.02E-05
Cadmium	ug/M3	7.10	4.30	1.62	4.34
	lb/hr	4.97E-04	2.54E-04	1.06E-04	2.86E-04
Lead	ug/M3	16.2	17.4	8.86	14.2
	lb/hr	1.13E-03	1.03E-03	5.80E-04	9.15E-04
Mercury	ug/M3	0.299	0.585	0.342	0.409
	lb/hr	2.09E-05	3.46E-05	2.24E-05	2.60E-05
Particulate Matter	mg/M3	62.8	27.1	15.6	35.2
	lb/hr	4.40	1.60	1.02	2.34
Volatile Organic Compounds	ppmvd	32.3	43.0	30.4	35.3
	lb/hr	1.50	1.70	1.33	1.51
Stack O ₂	%	20.9	20.9	20.9	20.9
Stack CO ₂	%	0.0	0.0	0.0	0.0
Stack Flow	dscfh	1120348	947868	1048346	1038854
Stack Flow	acfh	1111225	954678	1050798	1038900
Stack Moisture	%	1.4	2.2	1.6	1.7
Stack Velocity	ft/sec	74.08	63.65	70.05	69.26
Stack Temp	°F	61.4	65.4	65.8	64.2
Isokinetics	%	102.0	98.1	107.6	102.6

Table 2-10 Summary of Results – PM, Metals, VOC – Blend Feedstock – Scrubber/Cyclone #1

Parameter	Units	Run No.			Average
		Blend-C1-R1	Blend-C1-R2	Blend-C1-R3	
Date	MM/DD/YY	20-Nov-15	20-Nov-15	20-Nov-15	
Start Time	HH:MM	8:09	10:16	12:16	
Stop Time	HH:MM	9:09	11:21	13:16	
Beryllium	ug/M3	< 0.139	< 0.139	< 0.139	< 0.139
	lb/hr	< 1.89E-05	< 1.87E-05	< 1.85E-05	< 1.87E-05
Cadmium	ug/M3	1.96	1.57	1.45	1.66
	lb/hr	2.65E-04	2.12E-04	1.93E-04	2.23E-04
Lead	ug/M3	2.27	1.78	2.22	2.09
	lb/hr	3.07E-04	2.40E-04	2.95E-04	2.81E-04
Mercury	ug/M3	3.797	5.805	1.943	3.848
	lb/hr	5.14E-04	7.83E-04	2.59E-04	5.18E-04
Particulate Matter	mg/M3	8.50	8.61	10.08	9.06
	lb/hr	1.15	1.16	1.34	1.22
Volatile Organic Compounds	ppmvd	70.9	53.4	70.9	65.1
	lb/hr	6.38	4.79	6.29	5.82
Stack O ₂	%	20.9	20.9	20.9	20.9
Stack CO ₂	%	0.0	0.0	0.0	0.0
Stack Flow	dscfh	2167466	2158777	2133763	2153335
Stack Flow	acfh	2343394	2352288	2339266	2344983
Stack Moisture	%	2.9	2.8	3.3	3.0
Stack Velocity	ft/sec	86.79	87.12	86.64	86.85
Stack Temp	°F	90.3	95.1	95.5	93.6
Isokinetics	%	94.1	94.8	95.8	94.9

Table 2-11 Summary of Results – PM, Metals, VOC – Blend Feedstock – Cyclone #2

Parameter	Units	Run No.			Average
		Blend-C2-R1	Blend-C2-R2	Blend-C2-R3	
Date	MM/DD/YY	20-Nov-15	20-Nov-15	20-Nov-15	
Start Time	HH:MM	8:09	10:16	12:16	
Stop Time	HH:MM	9:09	11:21	13:16	
Beryllium	ug/M3	< 0.143	< 0.152	< 0.152	< 0.149
	lb/hr	< 9.43E-06	< 9.68E-06	< 9.71E-06	< 9.61E-06
Cadmium	ug/M3	2.21	0.918	1.10	1.41
	lb/hr	1.46E-04	5.86E-05	7.04E-05	9.15E-05
Lead	ug/M3	21.0	7.01	16.0	14.7
	lb/hr	1.39E-03	4.48E-04	1.02E-03	9.51E-04
Mercury	ug/M3	0.287	0.334	0.222	0.281
	lb/hr	1.89E-05	2.13E-05	1.42E-05	1.81E-05
Particulate Matter	mg/M3	30.5	12.2	20.3	21.0
	lb/hr	2.01	0.78	1.30	1.36
Volatile Organic Compounds	ppmvd	3.31	1.28	3.90	2.83
	lb/hr	0.145	0.055	0.166	0.122
Stack O ₂	%	20.9	20.9	20.9	20.9
Stack CO ₂	%	0.0	0.0	0.0	0.0
Stack Flow	dscfh	1055704	1022394	1022762	1033620
Stack Flow	acfh	1066561	1023790	1031693	1040681
Stack Moisture	%	1.9	1.1	1.8	1.6
Stack Velocity	ft/sec	71.10	68.25	68.78	69.38
Stack Temp	°F	63.5	63.1	63.7	63.4
Isokinetics	%	101.2	98.5	98.3	99.3

Table 2-12 Summary of Results – PM, Metals, VOC – Blend Feedstock – Cyclone #3

Parameter	Units	Run No.			Average
		Blend-C3-R1	Blend-C3-R2	Blend-C3-R3	
Date	MM/DD/YY	20-Nov-15	20-Nov-15	20-Nov-15	
Start Time	HH:MM	8:09	10:16	12:16	
Stop Time	HH:MM	9:09	11:21	13:16	
Beryllium	ug/M3	< 0.150	< 0.154	< 0.154	< 0.153
	lb/hr	< 9.87E-06	< 1.00E-05	< 9.97E-06	< 9.96E-06
Cadmium	ug/M3	1.30	0.777	0.687	0.921
	lb/hr	8.54E-05	5.06E-05	4.44E-05	6.01E-05
Lead	ug/M3	11.5	5.68	8.49	8.56
	lb/hr	7.55E-04	3.70E-04	5.49E-04	5.58E-04
Mercury	ug/M3	0.259	0.269	0.215	0.248
	lb/hr	1.70E-05	1.75E-05	1.39E-05	1.61E-05
Particulate Matter	mg/M3	15.6	10.8	11.3	12.5
	lb/hr	1.02	0.702	0.728	0.817
Volatile Organic Compounds	ppmvd	3.64	2.36	2.75	2.92
	lb/hr	0.159	0.102	0.118	0.127
Stack O ₂	%	20.9	20.9	20.9	20.9
Stack CO ₂	%	0.0	0.0	0.0	0.0
Stack Flow	dscfh	1051820	1044033	1034681	1043511
Stack Flow	acfh	1061745	1045640	1037997	1048461
Stack Moisture	%	2.2	1.0	1.1	1.4
Stack Velocity	ft/sec	70.78	69.71	69.20	69.90
Stack Temp	°F	62.9	63.8	64.4	63.7
Isokinetics	%	105.4	103.8	104.3	104.5

Table 2-13 Summary of Results – HAP – Auto Feedstock – Scrubber/Cyclone #1

Cyclone - Condition	Run No.	Date	Start Time	End Time	Max HAP Compound (lb/hr)	Sum of Detected HAP (lb/hr)
Scrubber/Cyclone 1 - Auto	Auto-C1-R1	18-Nov-15	9:59	10:59	Ethanol 7.60E-01	3.21E+00
Scrubber/Cyclone 1 - Auto	Auto-C1-R2	18-Nov-15	12:28	13:28	Ethanol 1.06E+00	4.47E+00
Scrubber/Cyclone 1 - Auto	Auto-C1-R4	19-Nov-16	7:39	8:39	Ethanol 1.29E+00	4.64E+00
Average Total Detected HAP (lb/hr)						4.11E+00

Table 2-14 Summary of Results – HAP – Auto Feedstock – Cyclone #2

Cyclone - Condition	Run No.	Date	Start Time	End Time	Max HAP Compound (lb/hr)	Sum of Detected HAP (lb/hr)
Cyclone 2 - Auto	Auto-C2-R1	18-Nov-15	10:01	11:01	2-Propanone 2.33E-01	3.97E-01
Cyclone 2 - Auto	Auto-C2-R2	18-Nov-15	12:28	13:28	Toluene 1.09E-01	2.40E-01
Cyclone 2 - Auto	Auto-C2-R4	19-Nov-16	7:39	8:39	Ethanol 1.20E-01	3.21E-01
Average Total Detected HAP (lb/hr)						3.19E-01

Table 2-15 Summary of Results – HAP – Auto Feedstock – Cyclone #3

Cyclone - Condition	Run No.	Date	Start Time	End Time	Max HAP Compound (lb/hr)	Sum of Detected HAP (lb/hr)
Cyclone 3 - Auto	Auto-C3-R1	18-Nov-15	9:59	10:59	2-Propanone 1.24E-03	7.41E-03
Cyclone 3 - Auto	Auto-C3-R2	18-Nov-15	12:28	13:28	Ethanol 1.60E-03	5.01E-03
Cyclone 3 - Auto	Auto-C3-R4	19-Nov-16	7:39	8:39	Ethanol 1.44E-03	5.07E-03
Average Total Detected HAP (lb/hr)						5.83E-03

Table 2-16 Summary of Results – HAP – [REDACTED] – Scrubber/Cyclone #1

Cyclone - Condition	Run No.	Date	Start Time	End Time	Max HAP Compound (lb/hr)	Sum of Detected HAP (lb/hr)
Scrubber Cyclone 1 - [REDACTED]	[REDACTED]-C1-R1	19-Nov-15	9:51	10:51	2-Propanone 1.39E+01	4.44E+01
Scrubber Cyclone 1 - [REDACTED]	[REDACTED]-C1-R2	19-Nov-15	12:32	13:32	2-Propanone 1.52E+01	5.60E+01
Scrubber Cyclone 1 - [REDACTED]	[REDACTED]-C1-R3	19-Nov-15	14:38	15:38	2-Propanone 1.70E+01	6.02E+01
Average Total Detected HAP (lb/hr)						5.36E+01

Table 2-17 Summary of Results – HAP – [REDACTED] – Cyclone #2

Cyclone - Condition	Run No.	Date	Start Time	End Time	Max HAP Compound (lb/hr)	Sum of Detected HAP (lb/hr)
Cyclone 2 - [REDACTED]	[REDACTED]-C2-R1	19-Nov-15	9:51	10:51	Ethanol 1.10E+00	1.83E+00
Cyclone 2 - [REDACTED]	[REDACTED]-C2-R2	19-Nov-15	12:32	13:32	Ethanol 1.33E+00	2.03E+00
Cyclone 2 - [REDACTED]	[REDACTED]-C2-R3	19-Nov-15	14:39	15:38	Ethanol 1.17E+00	2.81E+00
Average Total Detected HAP (lb/hr)						2.23E+00

Table 2-18 Summary of Results – HAP – [REDACTED] – Cyclone #3

Cyclone - Condition	Run No.	Date	Start Time	End Time	Max HAP Compound (lb/hr)	Sum of Detected HAP (lb/hr)
Cyclone 3 - [REDACTED]	[REDACTED]-C3-R1	19-Nov-15	9:51	10:51	Ethanol 2.18E-01	8.67E-01
Cyclone 3 - [REDACTED]	[REDACTED]-C3-R2	19-Nov-15	12:32	13:32	Ethanol 5.46E-01	1.36E+00
Cyclone 3 - [REDACTED]	[REDACTED]-C3-R3	19-Nov-15	14:38	15:38	Ethanol 5.16E-01	1.41E+00
Average Total Detected HAP (lb/hr)						1.21E+00

Table 2-19 Summary of Results – HAP – Blend Feedstock – Scrubber/Cyclone #1

Cyclone - Condition	Run No.	Date	Start Time	End Time	Max HAP Compound (lb/hr)	Sum of Detected HAP (lb/hr)
Scrubber/Cyclone 1 - Blend	Blend-C1-R1	20-Nov-15	8:09	9:09	Ethanol 7.32E+00	1.21E+01
Scrubber/Cyclone 1 - Blend	Blend-C1-R2	20-Nov-15	10:16	11:21	Ethanol 3.07E+00	6.12E+00
Scrubber/Cyclone 1 - Blend	Blend-C1-R3	20-Nov-15	12:16	13:16	Ethanol 2.84E+00	5.23E+00
Average Total Detected HAP (lb/hr)						7.83E+00

Table 2-20 Summary of Results – HAP – Blend Feedstock – Cyclone #2

Cyclone - Condition	Run No.	Date	Start Time	End Time	Max HAP Compound (lb/hr)	Sum of Detected HAP (lb/hr)
Cyclone 2 - Blend	Blend-C2-R1	20-Nov-15	8:09	9:09	Ethanol 6.00E-01	8.82E-01
Cyclone 2 - Blend	Blend-C2-R2	20-Nov-15	10:16	11:21	Toluene 1.54E-01	3.74E-01
Cyclone 2 - Blend	Blend-C2-R3	20-Nov-15	12:16	13:16	Ethanol 6.28E-02	1.61E-01
Average Total Detected HAP (lb/hr)						4.73E-01

Table 2-21 Summary of Results – HAP – Blend Feedstock – Cyclone #3

Cyclone - Condition	Run No.	Date	Start Time	End Time	Max HAP Compound (lb/hr)	Sum of Detected HAP (lb/hr)
Cyclone 3 - Blend	Blend-C3-R1	20-Nov-15	8:09	9:09	Ethanol 3.65E-01	4.44E-01
Cyclone 3 - Blend	Blend-C3-R2	20-Nov-15	10:16	11:21	Ethanol 6.73E-02	9.83E-02
Cyclone 3 - Blend	Blend-C3-R3	20-Nov-15	12:16	13:16	Tetrachloroethylene 5.15E-01	6.00E-01
Average Total Detected HAP (lb/hr)						3.81E-01

3.0 SOURCE, SAMPLING POINT AND PROCESS DATA DESCRIPTION

3.1 Industrial Activities Description

wTe Recycling receives a variety of post-consumer and post-industrial metals, processes them as required by the end users, and ships the recycled metals to market via rail car or truck. The specific processing methods employed are determined by the characteristics of the material. Processing methods include both manual and mechanical sorting, and both manual and mechanical size reduction. Most of the materials processed require some type of size reduction in order to be efficiently sorted, transported and recycled. A hammermill shredder is the principal device used for size reduction. Shredding is a mechanical process which does not rely on combustion or a chemical reaction. By reducing the size of the metal pieces, shredding allows downstream equipment to sort the feed stream into a non-metallic residue component, ferrous metals, and non-ferrous metals.

3.2 Shredding System Design and Operation

3.2.1 Technology Description

Feedstocks requiring size reduction by the shredder generally include light iron, [REDACTED] and auto hulks. Light iron consists primarily of ferrous metal objects such as discarded appliances and other household goods. [REDACTED]

[REDACTED] Auto hulks consist of crushed automobiles that have been prepared for shredding. Automobile preparation for shredding includes the removal of all fluids (oils, coolants, Freon, etc.), gas tanks, mercury switches and any other hazardous components in accordance with applicable law.

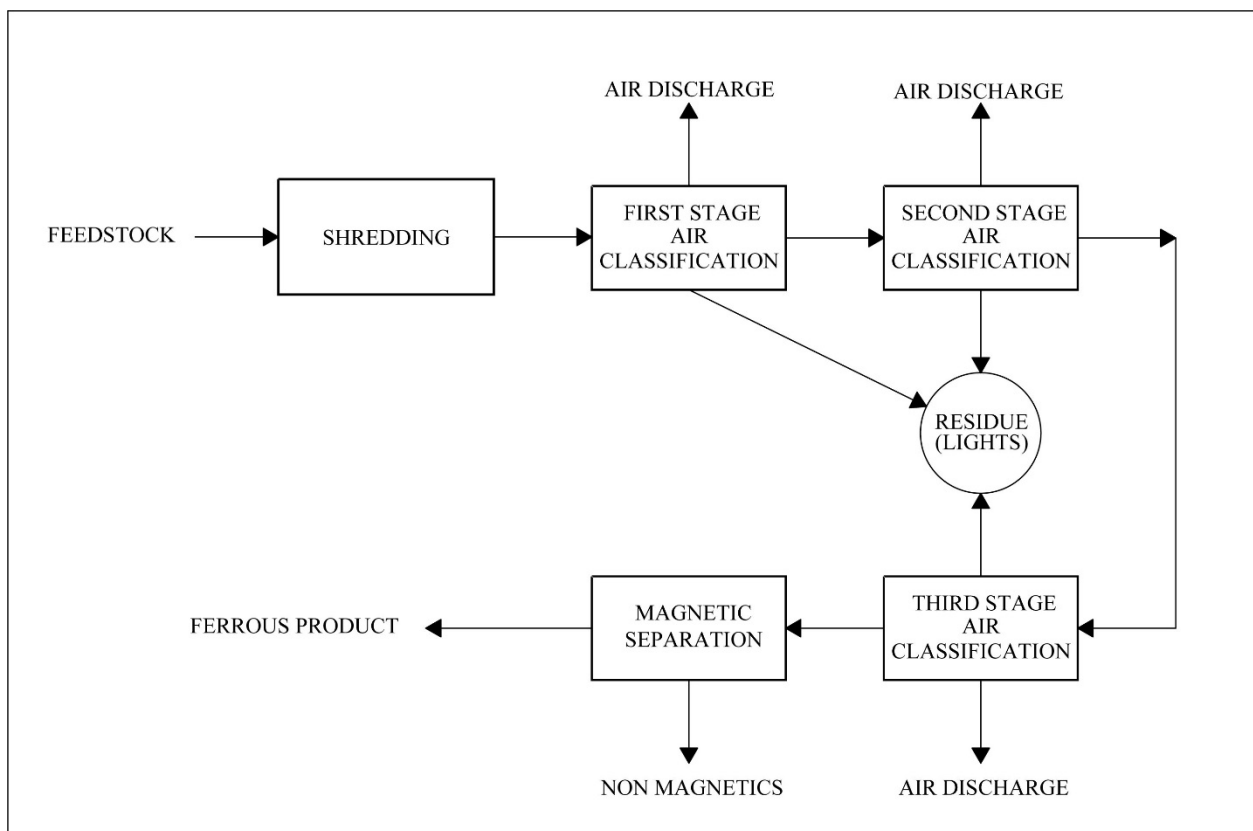
The shredder contains rotating hammers which force the feedstock against a cutting bar and a grate. This action reduces the particle size until it is small enough to pass through the grate openings. The fragments are also pounded into a somewhat spherical shape, increasing their bulk density. Non-metallic contaminants are liberated from the metals through this size reduction process and subsequently are collected as a separate stream. The non-metallic residuals from pre-burn and PIF feedstocks are returned to their point of origin for disposal. [REDACTED]

[REDACTED]

In spite of a thorough pre-processing inspection, any of these feedstocks can (and sometimes do) contain materials that can be explosive (for example, partially filled propane tanks) when shredded. As a consequence of this safety hazard, an extended area around the shredder is closed to personnel during the shredding operation.

A shredding process flow diagram is presented in Figure 3-1.

Figure 3-1 – Shredding Process Flow Diagram



3.2.2 Air Classification/Emissions Control

As shown in Figure 3-1, the wTe shredding line includes three stages of air classification and emissions control to remove fumes, dust and light non-metallic materials. The first air classifier draws air through a collection hood and into a wet scrubber/cyclonic separator. Fumes, dust, and small light pieces of paper and plastics are extracted by the air stream. As the air enters the cyclonic separator it circles in a high G force spiral pattern where solid particles are forced to the wall, where they then slow down to a point where they become separated from the vortex and fall to the outlet below. These separated particles drop onto a conveyor and are consolidated in a storage bunker for disposal as residue. Ultra-fine particles and aerosols that are not heavy enough to be de-entrained from the air stream are discharged out the top of the cyclone into a wet particulate scrubber where they are removed via collision with liquid droplets in a fine water mist.

The second and third particulate control stages are identical to each other. These are designed to remove paper, plastic, fabric, and other light particles not captured in the first air classification step. Each consists of a cascade over which the shredded feedstock tumbles. Two fans are used to liberate the light materials, one on the underside of the cascade to “fluff” the material as it drops from step to step, and one on the top side of the cascade to pull liberated materials into a collection system. Particles collected in this way are fed into cyclone separators. The solids conveyed by the air are separated by the cyclone and drop onto a conveyor belt and are conveyed into a storage bunker for consolidation as non-metallic residue. The conveying air, following particulate removal in the cyclones, exits the system through a down-facing exhaust duct equipped with a water injection system to control uncollected fine particulates.

3.2.3 Magnetic Separation (ferrous recovery process)

The material remaining in the Process after the air classification systems consists of ferrous and non-ferrous metals, glass, rubber, wood, ceramics and other heavy non-metallic materials, and any paper and plastic that were not removed in the three air classification steps. Two magnetic drums are used in series to extract ferrous metals from this stream. Materials not attracted to either magnet are conveyed to a storage bunker for future processing in the Upper Sort non-ferrous process. But before these materials enter the storage bunker they pass under an overhead magnet. Any ferrous attracted by this magnet is returned to the shredding line and fed once again to the second magnetic drum.

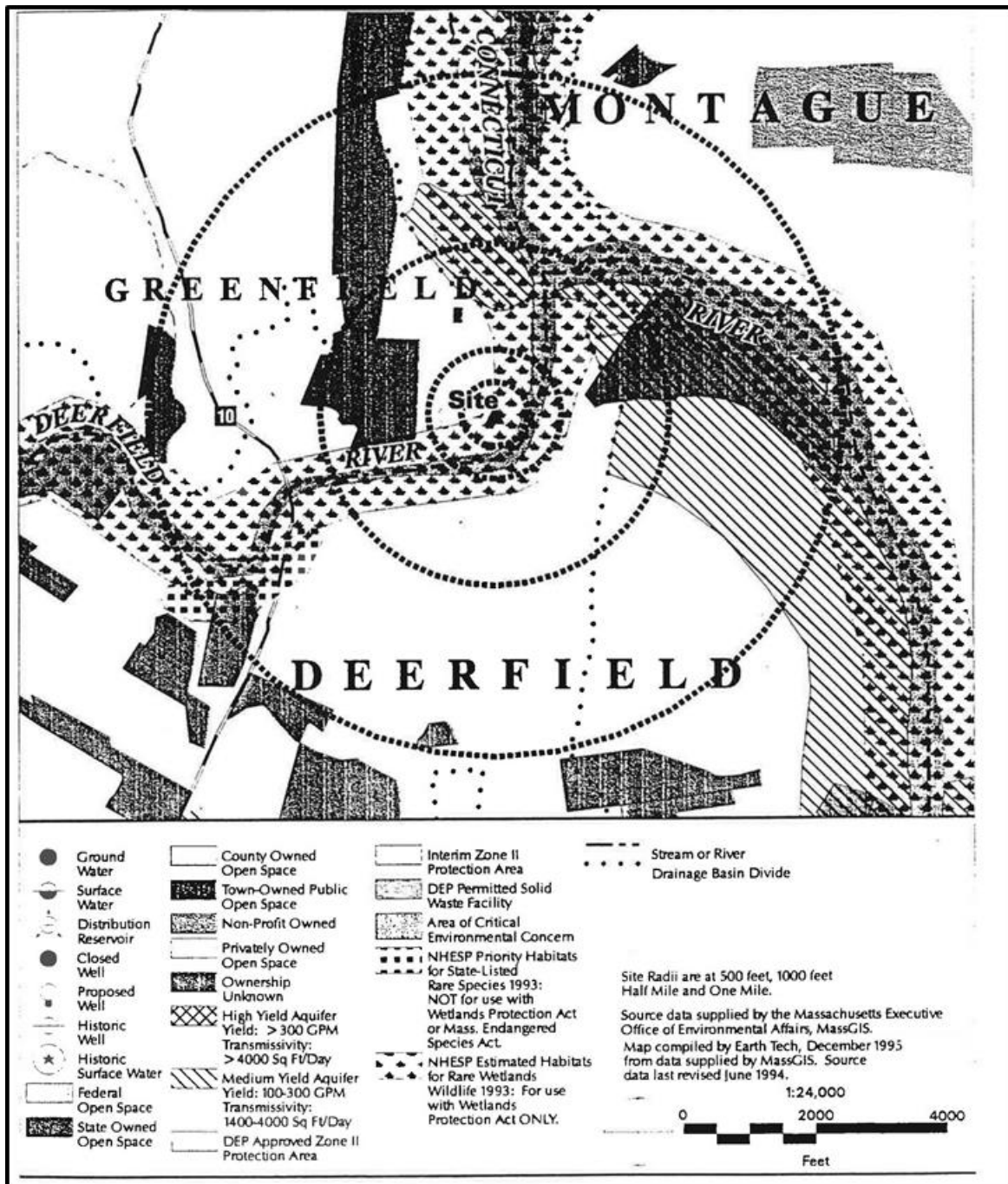
3.2.4 Inspection and Sorting (ferrous recovery process)

The ferrous product extracted by the two magnetic drums passes through a picking station, located downstream of the shredding operation, where workers remove any large non-magnetic items as well as copper motor windings. The ferrous material passing the picking station is stacked in a finished product pile.

3.3 Process Data

Process data was collected by facility personnel throughout the test program. All process data is summarized in Appendix F of this Final Report.

Figure 3-2 – GIS Map

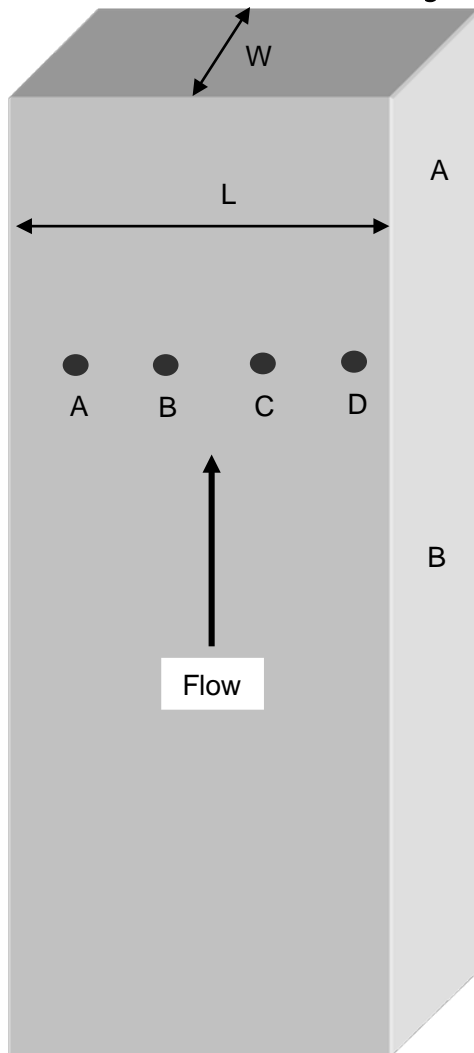


3.4 Sampling Point Description

3.4.1 Wet Scrubber/Cyclone #1 Sampling Location

Testing at the scrubber/cyclone outlet location utilized four sampling ports located along the face of the ductwork on a vertical section of stack with inside dimensions of 40.0 inches by 27.0 inches. The ports were 16.8 feet, or 6.3 equivalent diameters from the nearest downstream flow disturbance, and 19.2 feet or 7.1 equivalent diameters from the nearest upstream flow disturbance. Each port was 3 inches in diameter. A summary of the traverse points is presented in Figure 3-3. As per EPA Method 1 requirements, this test location required a 12 point flow traverse. All measurements were verified onsite prior to testing.

Figure 3-3 – Sampling Configuration – Scrubber Outlet

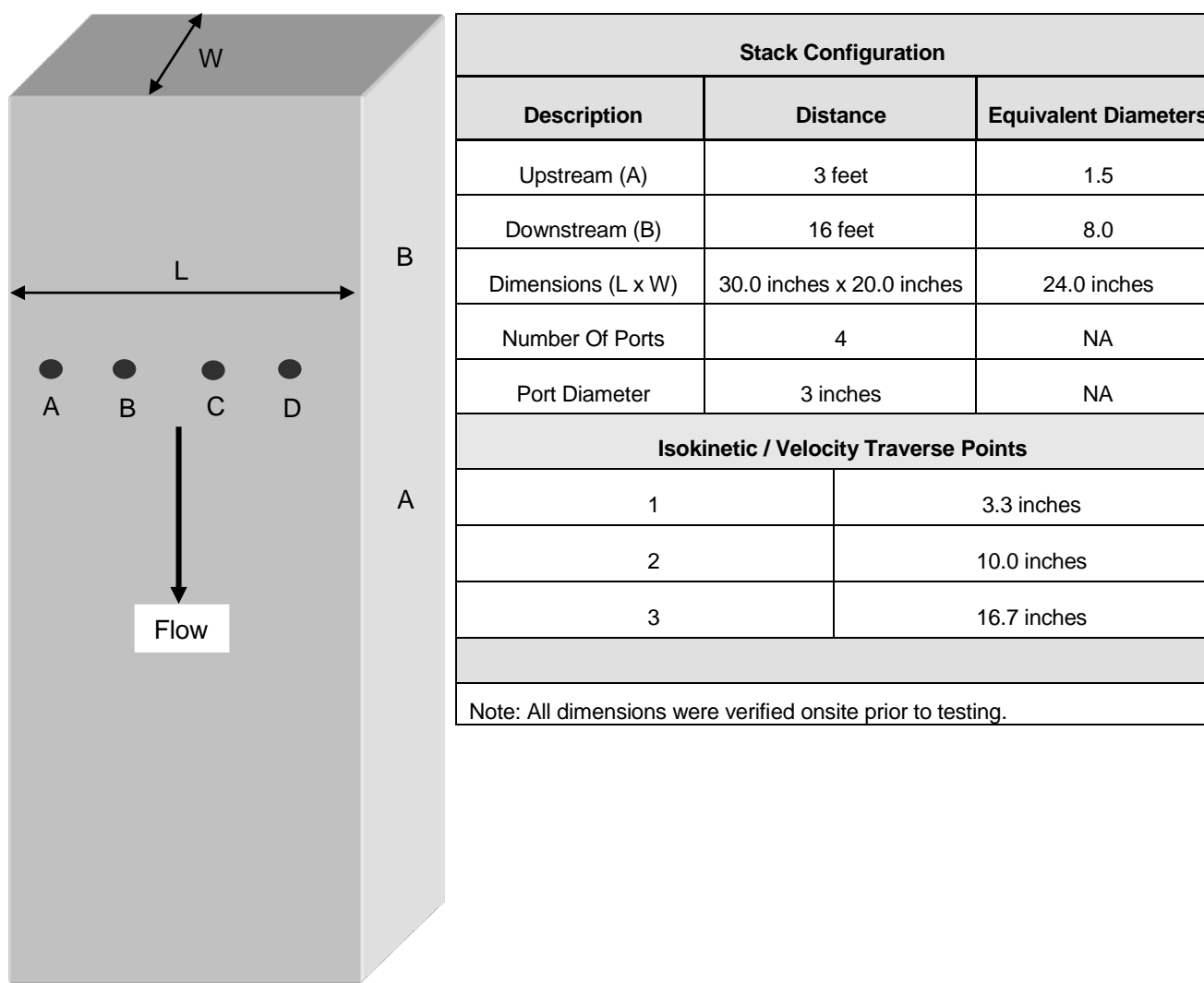


Stack Configuration		
Description	Distance	Equivalent Diameters
Upstream (A)	16.8 feet	6.3
Downstream (B)	19.2 feet	7.1
Dimensions (L x W)	40.0 inches x 27.0 inches	32.2 inches
Number Of Ports	4	NA
Port Diameter	3 inches	NA
Isokinetic / Velocity Traverse Points (per port)		
1	3.4 inches	
2	10.1 inches	
3	16.9 inches	
4	23.6 inches	
Note: All dimensions were verified onsite prior to testing.		

3.4.2 Cyclone #2 and Cyclone #3 Sampling Locations

Testing on each cyclone (both 2 and 3 are identical in dimensions) outlet location utilized four sampling ports located along the face of the ductwork on a vertical section of stack with inside dimensions of 30 inches by 20 inches. The ports were downstream 6 feet, or 8.0 equivalent diameters from the nearest flow disturbance, and upstream 3.0 feet or 1.5 equivalent diameters from the nearest flow disturbance. Each port was 3" in diameter. A summary of the traverse points is presented in Figure 3-4. As per EPA Method 1 requirements, this test location required a 16 point flow traverse. However, the onsite EPA administrator allowed isokinetic traversing at 12 points due to the difficult configuration of the sampling location and the high risk of glass breakage. All measurements were verified onsite prior to testing.

Figure 3-4 – Sampling Configuration – Cyclones 2 and 3 Outlets



4.0 TEST PROCEDURES

4.1 Overview

Each pollutant parameter was tested in strict accordance with official EPA procedures in the manner of a compliance test at the locations as described in Section 3.0. This section discusses the sampling and analysis procedures utilized for each pollutant.

4.2 Methodology

4.2.1 Particulate Matter – EPA Method 5

Particulate matter was measured using EPA Methods 1 through 5. Particulate matter and trace metals were collected on a combined sampling train that was configured in accordance with EPA Method 5 and 29. Method 5 measurements include the determination of the proper number of sampling points and their locations in the stack (RM1), stack velocity and volumetric flow rate (RM2), stack gas molecular weight (RM3) and stack gas moisture content (RM4). The train was an EPA Method 5-type isokinetic sampling train. Sampling was conducted isokinetically for a period of 60 minutes per run, collecting a minimum sample volume of 30 dry standard cubic feet.

The volumetric flow rate was determined during each test run in accordance with EPA Methods 1-2 so that the mass emissions of all parameters could be calculated.

The sampling train consisted of a glass nozzle, Teflon union, glass-lined probe, a glass filter holder, quartz glass filter, Teflon filter support, and a series of impingers (please see Section 4.2.2 for specific impinger configuration due to combining of Method 5 and Method 29). All glassware were thoroughly cleaned and sealed as per EPA Method 29 and prior to mobilization.

All filters and beakers were weighed before and after sampling in strict accordance with Method 5 and the EPA Quality Assurance Handbook. They were desiccated for at least 24 hours, and then weighed at six-hour intervals until two consecutive weighings demonstrated a constant weight were within ± 0.5 milligrams.

Prior to sampling, a K-factor was established, and the train was assembled and leak checked (both sampling train and pitots). After the probe and filter box reached the desired operating temperature, the probe was placed in the stack, and isokinetic sampling took place.

At the completion of isokinetic sampling, the train was leak checked, disassembled, and sealed. All train recovery procedures were conducted in accordance with EPA Method 5 and 29. The tared filter was carefully removed from the filter holder, placed in a labeled petri dish and stored in a portable desiccator. The nozzle, probe and filter holder front half were thoroughly brushed and rinsed with acetone into a container labeled for identification, followed by rinsing with 0.1N HNO₃ in accordance with EPA Method 29. Volumes were noted and liquid levels marked.

A set of reagent blanks were also taken for analysis along with the samples. The impinger condensate was recovered in accordance with EPA Method 29 procedures.

Particulate samples were analyzed gravimetrically at Maxxam Analytics of Burlington, Ontario in accordance with Method 5 and 29. The acetone rinses were evaporated to dryness in tared beakers. All filters and beakers were desiccated before and after sampling for 24 hours, and weighed at 6-hour intervals until two consecutive weights were within ± 0.5 mg. Filters and acetone residue were then subjected to trace metals analysis in accordance with EPA Method 29. Additional information can be found in the Quality Control Procedures section of this Final Report.

4.2.2 Trace Metals – EPA Method 29

Trace metals emissions were determined in strict accordance with EPA Method 29. Particulate matter and trace metals were collected on a combined sampling train that was configured in accordance with EPA Methods 5 and 29. The metals of concern associated with shredding operations are the HAP metals mercury (Hg), lead (Pb), cadmium (Cd) and beryllium (Be). Sampling was conducted isokinetically for a period of 60 minutes per run, collecting a minimum of 30 dry standard cubic feet.

The multi-metals sampling train consisted of a basic EPA Method 5 train with a glass nozzle, Teflon union, glass probe liner, glass filter holder, tared quartz glass fiber filter, Teflon filter support, and additional impingers. The first and second impingers each contained 100 ml of 5% HNO₃/10% H₂O₂ absorbing solution. The third impinger was initially empty. The fourth and fifth impingers each contained 100 ml of 4% KMnO₄/10% H₂SO₄. The sixth impinger contained a pre-weighed amount of silica gel.

Prior to mobilization, all glassware for the multi-metals method was washed in hot water and detergent, thoroughly rinsed with tap water, soaked for at least 8 hours in a 10% HNO₃ bath, rinsed clean with HPLC-grade H₂O, rinsed with HPLC-grade acetone, allowed to dry, sealed and labeled.

Following each run, samples were carefully recovered in the field laboratory. Each train yielded seven samples: 1) The filter was carefully removed and placed in a prepared amber bottle; 2) The front half, including the nozzle, probe, cyclone bypass filter holder front half were rinsed with a Teflon brush and 100 ml of acetone into a prepared glass amber bottle; 3) The front half, including the nozzle, probe, cyclone bypass filter holder front half were rinsed with 100 ml of 0.1N HNO₃ into a prepared glass amber bottle; 4) The back half, including the frit, filter holder back half, connecting glassware, plus the first and second impingers and contents were rinsed with 100 ml of 0.1N HNO₃ into a prepared amber bottle; 5) The third impinger and contents were measured and rinsed with 100 ml of 0.1N HNO₃ into a prepared amber bottle; 6) The fourth and fifth impingers and contents were measured and rinsed into a glass amber bottle with 100 ml of 4% KMnO₄ / 10% H₂SO₄ followed by 100 ml of deionized water into the same container; and 7) The fourth and fifth impingers were cleaned with 25 ml of 8N HCl and 100 ml of DI H₂O into a separate amber bottle. The impinger volumes were recorded to determine the moisture net gain. The silica gel in the sixth impinger was weighed to determine moisture content and discarded. Reagent blanks were collected in accordance with the method. All samples were labeled, logged, and stored in a cool, dark area until delivery to the analytical laboratory.

The analysis was conducted via GFAA, ICAP and CVAA (Hg only) instrumentation at Maxxam Analytics of Burlington, Ontario.

4.2.3 VOCs – EPA Method 25A

VOCs were determined in accordance with EPA Method 25A. Eastmount met the requirements of Method 25A by utilizing a Teco Model 51 at each of the three sampling locations. The analyzers were calibrated with certified methane-in-air standards. Each analyzer was calibrated prior to and following each test run to ensure the accuracy of the test data. Each test run consisted of sampling for 60 minutes. All runs were conducted in triplicate. Volumetric flow rate was determined during each run in accordance with EPA Methods 1 and 2 to allow calculation of mass emissions in lb/hr. Velocity data used in the calculation of flow rate was obtained from the EPA Method 5/29 sample train data.

4.2.4 HAPS – EPA Method TO-15 (Summa)

Hazardous air pollutants or HAPs were measured by utilizing EPA Method TO-15. This method utilizes evacuated Summa canisters equipped with critical orifices to allow integrated sampling across a 60-minute period. All test runs were conducted in triplicate at each location under each process scenario. Sample were analyzed by Maxxam Analytical of Burlington, ON using Gas Chromatography / Mass Spectroscopy (GC/MS) to determine the concentration of total HAPs in the sample.

4.3 Description of Isokinetic Sampling

What follows is a general description of the sampling train and operational procedures for the isokinetic sampling methods.

4.3.1 Isokinetic Sampling Equipment

The isokinetic sampling trains used during these tests were manufactured by Clean Air Engineering. The design specifications of this train meet all the requirements of EPA's Reference Method 5 as found in the Federal Regulations under Section 40 CFR 60 Appendix A, as amended. The following is a description of the individual pieces of equipment that make up the train.

Nozzle - The nozzle was constructed of quartz glass of the buttonhook design. A range of sizes suitable for isokinetic sampling was available. All nozzles were calibrated before testing.

Probe - A 2 or 3-foot effective heated stainless steel probe with heated quartz or borosilicate glass liner was used at the stack locations.

Heating System - The filter outlet temperature was maintained between 65 and 85°F by regulating the probe and hotbox temperature accordingly.

Pitot Tube - A Type S pitot tube attached to the probe was used to monitor the stack gas velocity. Since the pitot tube met all of the dimensional criteria set forth in Method 2 of 40CFR60, a coefficient of 0.84 was used.

Filter Holder - A borosilicate glass type filter holder with a Teflon support was used for all isokinetic testing.

Condenser - Four to seven impingers, connected in series with leak-free ground glass fittings, were used as the condenser. Please refer to Section 4.2.1 – 4.2.2 for specific impinger configurations per test method.

Metering System - A vacuum gauge, inclined manometer, leak-free pump, calibrated thermocouples, and a calibrated dry gas meter were the basic components used to meter the dry sample gas through the system.

Gas Molecular Weight Determination – The sources were essentially at ambient temperature, and therefore the dry molecular weight of ambient air was used in the gas velocity calculation.

4.3.2 Isokinetic Sampling Procedures

All sampling procedures were conducted in strict accordance with the Methods prescribed in the Code of Federal Regulations as found in 40CFR60 as amended, where available. The following is the sequence of events that occurred prior to and during the actual tests.

Traverse Points - The traverse points were calculated in accordance with Method 1 and the probe was marked accordingly.

Static Pressure - The static pressure of the ducts was checked and recorded.

Preliminary Traverse - A preliminary traverse was conducted. Readings included the pressure drops and gas temperatures.

Nomograph - Once the above information had been obtained, the nomograph for the actual test was set up to correlate the isokinetic relationships.

Barometric Pressure - The barometric pressure was recorded by the use of a NIST traceable digital barometer onsite.

Sampling Train Set-Up:

(a) The filter was placed in the filter holder and visually checked. The filter number and tare weight were

recorded on the Chain of Custody form.

(b) The impingers were loaded with the appropriate absorbing solution. Volumes (or initial weights) were recorded on the field data sheets.

(c) Approximately 200 grams of silica gel were placed in the final impinger. Exact weights were logged on the field data sheets.

(d) Crushed ice was placed around the impingers.

(e) Once the entire train was assembled, the probe and hot box heaters were turned on.

Pre-Test Leak Check - Once the heater box was at the desired temperature for testing, the system was leak checked at fifteen inches of vacuum (15"Hg). A leak rate of less than 0.02 CFM was achieved prior to the start of sampling.

Final Check – When sampling was ready to commence, plant operations were checked to confirm that the shredder process line was operating at the desired capacity.

Sampling - Isokinetic sampling, per the Reference Method then took place.

Post-Test Leak Check - Upon completion of each test run, the system was leak checked at the highest vacuum recorded during that run. All leak checks less than 0.02 CFM were considered acceptable.

Sample Recovery - All samples were recovered according to the respective Reference Method procedures. Because of the extreme importance of proper sample recovery techniques, details of the sample recovery procedures may be found in Section 5 of this Report.

Isokinetics - Once all sample recovery was completed (including moisture determination), calculations were conducted to determine the percent isokinetics of the test run.

4.4 Description of VOC Sampling

This section outlines all procedures associated with the VOC testing for the program.

4.4.1 VOC Sampling System Description

What follows is a description of the transportable continuous emissions monitor system that was used to quantify each of the diluents/pollutants that comprise this test program.

4.4.1.1 Sample Conditioning and Delivery System

- **Sample Probe** - A stainless steel probe of sufficient length to reach the centroid of the duct. The probe was comprised of a 5/8" OD 316 stainless steel tube encased with a heating mantle and outer sheath. The probe is identical to a commercially produced (i.e. Apex instruments) isokinetic probe with the exception that it does not possess, a stack thermocouple, pitot tubes or an orsat line.
- **Filter** - A spun glass fiber filter contained in a heated sheath. The filter is located between the sample probe and sample line, it is designed to remove particulate from the gas stream.
- **Sample Line** - 3/8" Teflon tubing in a heated sample line designed to transport the sample gas from the probe to the sample conditioning system.
- **Sample Pump** - A diaphragm type vacuum pump to draw gas from the probe through the conditioning system and to the analyzers. The pump head is stainless steel, the valve disks are Viton and the diaphragm is Teflon coated.
- **Sample Distribution System** - A series of flow meters, valves and backpressure regulators allows the operator to maintain constant flow and pressure conditions during sampling and calibration.

4.4.1.2 Calibration System

- **Calibration Gases** – EPA Protocol Gases certified in accordance with EPA Protocol G1 procedures.
- **Calibration Line** – Teflon line (1/4") run in parallel to the sample line.

- **Calibration Tee** - Stainless steel tee (3/8") located between the probe and the filter that allows the operator to inject calibration gas through the entire sampling system. Excess calibration gas exits the probe eliminating any potential over pressurization.

4.4.1.3 Data Acquisition System

- **Computer** – A Dell VOSTRO 1710 or equivalent
- **Software** – Iotech data acquisition system (Personal DAQ 55/56). This system is programmed to collect data once per every 2 seconds, while reporting 1-minute averages. This software operates in a Windows environment.

4.4.2 VOC Sampling and Calibration Procedures

The VOC analyzer was calibrated prior to sampling using zero, low, mid and high methane standards in balance air calibration gases, certified in accordance with EPA Protocol 1 procedures. Calibrations were conducted through the entire sample system. A description of the specific procedures is provided below:

- **Zero:** The zero point of the analyzer was determined using a pre-purified cylinder of ultra-high purity (UHP) air. The zero point was analyzed for a minimum of five minutes to monitor drift before sampling commences.
- **High:** The high calibration gas was 80-90% of span. It was introduced to the sample system and the response of the analyzer was adjusted accordingly.
- **Mid:** The mid calibration gas was 45-55% of span. It was introduced to the sample system and the response of the analyzer recorded.
- **Low:** The low calibration gas was 25-35% of span. It was introduced to the sample system and the response of the analyzer was recorded.

Once the analyzer was calibrated, the system was switched to sample mode and sampling commenced. The response time of the system was determined from the time the calibration gas was shut off to the time the response of the FIA was 95% of the steady state sample value. The DAS then recorded the analyzer response throughout the test run. Following the test run, the sampling system was post calibrated. The post calibration consisted of delivering zero and a representative upscale calibration gas

through the entire sampling system and recording the system response. This response was used in conjunction with the initial system calibration in order to determine calibration drift over the test run period.

4.5 HAP TO-15 (Summa) Sampling System Description

Summa sampling for HAP consisted of drawing a sample through virgin ¼-inch Teflon line which was connected to a Summa canister equipped with a critical orifice and vacuum gauge. Prior to field sampling, each canister was completely evacuated. Maxxam Analytics had previously recorded the initial vacuum of the canister on the label. Each canister received an identification number.

Prior to sampling, the canister label was marked with the test ID number. The Teflon line, critical orifice and vacuum gauge were connected to the canister. The end of the Teflon line was placed into stack, and the valve was opened at the beginning of the test run. At the completion of the test run, the canister valve was shut, and the Summa was removed from the sampling location and stored onsite.

All Summa canisters were shipped to Maxxam Analytics for analysis of TO-15 HAP compounds via GC/MS. Results were reported in units of ug/M3 to allow calculation of mass emissions in lb/hr.

5.0 QUALITY ASSURANCE/QUALITY CONTROL

5.1 Overview

Strict QA/QC protocols were followed during all phases of this project. These protocols included:

- QA objectives for measurement data;
- Data reduction;
- Internal QC;
- Calibration of equipment;
- Corrective action, if necessary; and
- Use of standardized field data sheets.

The following sections summarize specific aspects of the test program.

5.2 VOC Sampling

The following subsections present the CEMS criteria for measurement of VOC that were adhered to throughout the conduct of the test program.

5.2.1 Leak Check

Prior to the initiation of testing, the reference method VOC system was leak checked from the end of the sampling probe by ensuring that the system vacuum reached the capacity of the sampling pump (~20"Hg) while all rotameters indicated no flow. If a leak was detected, it was traced, fixed and the leak check procedure repeated until successful.

5.2.2 System Response Time

Prior to the initiation of sampling, a reference method VOC system response time was determined. During the test program, the system was allowed to sample a minimum of 2.0 times the response time prior to the initiation of any sampling runs.

5.2.3 Calibration Gases

All calibration gases utilized were prepared according to EPA Protocol standards.

5.2.4 Calibration Criteria

- **Calibration Error** – At the beginning of each test day, or as necessary, a calibration error test was conducted for each analyzer channel for the low and mid level gases, as follows. Following instrument calibration (zero and span), the mid and low range calibration gases were injected and the instrument responses recorded. From these values the calibration error was calculated for low and mid level gases in accordance with the formula presented below. The maximum allowable calibration error is 5% of the expected value for both the low and mid level gases. If this limit was not achieved, corrective action was taken and the procedure repeated until successful.

$$\text{Calibration Error} = \frac{(\text{Concentration}_{\text{Response}} - \text{Concentration}_{\text{Predicted}})}{\text{Concentration}_{\text{Cylinder}}} \times 100$$

- **Calibration Drift** – Following the initial valid calibration error check and following each subsequent test run, a calibration drift test was conducted using the zero and a mid level gas for each analyzer channel. As such, following each of the test runs, the zero and mid level calibration gases were injected and the instrument responses recorded. From these values, calibration drift was calculated in accordance with the formula presented below. The maximum allowable calibration drift is 3% of instrument span. If this limit was not achieved, the data was considered invalid, corrective action taken and the calibration procedures repeated until successful.

$$\text{Drift} = \left| (\text{Response}_{\text{final}} - \text{Response}_{\text{initial}}) / \text{Instrument Span} \right| \times 100$$

5.3 Isokinetic Sampling

5.3.1 General

Isokinetic sampling was used to quantify particulate matter and trace metals. The reference method sample trains were leak-checked prior to and following each test run. This ensured that a representative sample was drawn from the stack during each run.

Reference Method 1 was used for the selection of traverse points. Method 2 was used for the determination of volumetric flow. Method 3 was not used as the sources were essentially ambient. Method 4 was used for the determination of moisture.

5.3.2 Equipment Calibrations

Montrose's meter boxes, pitot tubes, thermocouples and barometers are maintained in accordance with specifications set forth in EPA "Quality Assurance Handbook for Air Pollution Measurement Systems - Volume III Stationary Source Specific Methods" Section 3.3.5 dated January 15, 1980 and with the manufacturer's suggested procedures. A summary is presented below:

- **Dry Gas Meter and Orifice Meter/EPA Method 5** - All dry gas meters are calibrated using calibrated critical orifices, according to 40 CFR 60, Appendix A, Method 5, Section 16.2. The orifice meters in the meter control boxes are calibrated against the calibrated critical orifices and checked against the dry gas meters to which they are attached.
- **Balance** – Balances used to weigh Method 5 filters and acetone washes are calibrated using ASTM/ANSI Class 2 weights. All field balances used to weigh impingers/sigel are calibrated against ASTM/ANSI Class 7 weights.
- **Thermocouples** - All type K thermocouples are calibrated against ASTM mercury in glass thermometers at three points. The first point is in an ice bath (0°C), the second point is in boiler water (100°C) and the third point is in heated oil (~220°C).
- **Pitot Tubes** - All standard and Type "S" stainless steel pitot tubes are designed to meet the dimensional criteria set forth in Method 2, therefore a coefficient of 0.99 (standard) or 0.84 (Type "S") is used.

5.3.3 Cyclonic Flow Check

Prior to sampling, a cyclonic flow check was conducted in accordance with Section 11.4 of EPA Method 1. In summary, at each traverse point (see Figures 3-3 and 3-4) the pitot tube was rotated perpendicular to the cross sectional area of the stack (this is zero degrees). The probe was then rotated (if necessary) until a null pitot reading was obtained. The angle was recorded for each point and then the absolute value of each angle was used to calculate an overall average cyclonic flow angle. For the test location to be deemed acceptable, this average absolute value must be less than or equal to 20 degrees.

5.4 Particulate Matter / Trace Metals QA/QC – EPA Method 5/29

A description of the QA/QC procedures for trace metals test runs is presented in Table 5-1.

Table 5-1 QA/QC Procedures for Trace Metals – EPA Method 29

Task	Procedure
Glassware/ Teflon Preparation	<ol style="list-style-type: none"> 1. Wash all glassware and Teflon components in warm, soapy water. Rinse clean with tap water. Rinse thoroughly with DI water. 2. Soak all components in 10% nitric acid for 8 hours. Rinse all train components with DI water and acetone. Allow to air dry and seal with parafilm. 3. Use only high purity quartz filters and glass or Teflon components.
Sampling Train Set up	<ol style="list-style-type: none"> 1. Load/assemble sampling train components in field lab. Re-seal components and send up to stack. 2. Finish assembling train on stack. Leak check train with Teflon tape on finger.
Sampling Train Operation	<ol style="list-style-type: none"> 1. Operate sampling train between 0.5 and 1.0 cfm. 2. Leak check train with Teflon tape on finger. Seal train components with parafilm.
Sampling Train Recovery	<ol style="list-style-type: none"> 1. Return filter to petri dish (Container A) 2. Rinse nozzle through front half of filter holder with 100 ml of acetone into Container B. 3. Rinse nozzle through front half of filter holder with 100 ml of 0.1N HNO₃ into Container C. 4. Rinse filter holder back half through second impinger with 100 ml of 0.1N HNO₃ into container D along with condensate. 5. Rinse third impinger with 100 ml of 0.1N HNO₃ along with condensate into Container E. 6. Rinse fourth and fifth impinger impingers with 100 ml of acid potassium permanganate and 100 ml of DI H₂O into Container F along with condensate. 7. Clean fourth and fifth impingers with 25 ml of 8N HCl and 200 ml H₂O into Container G. 8. Use Teflon squeeze bottles, spatulas for recovery. 9. Obtain reagent and filter blanks.
Sample Identification and Shipping	<ol style="list-style-type: none"> 1. Identify all samples by stack, method, run no. fraction and contents. 2. Generate chain of custody form identifying all samples. 3. Ship samples to analytical laboratory.
Sample Analysis	<ol style="list-style-type: none"> 1. Receive samples, verify chain of custody/contents. 2. Evaporate front half acetone rinse in tared beaker. 3. Desiccate filters and beakers for 24 hours. Weight at six hour intervals until two consecutive weights agree by ± 0.5 mg. 4. Reconstitute beaker residue in accordance with Method 29. 5. Prepare for metals analysis. Calibrate instrumentation with standards prior to sample analysis. Calibration is verified with a lab control sample to verify the primary standard. Must be within 10% of true value 6. Inject field emissions samples in duplicate to demonstrate reproducibility (20% agreement). 7. A continuing calibration check is performed every 10 samples (20 injections). At completion, a final calibration verification is performed (20% agreement). 8. Spike separate sample aliquot with a known amount of standard for each analyte (one for front $\frac{1}{2}$ and one for back $\frac{1}{2}$ samples), and analyze along with emissions samples. The spike recovery must be between 70% and 125% to be considered acceptable.